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Subject: Fwd: Updated Rosemont Mitigation & Prioritization of projects
Date: Thursday, April 10, 2014 2:51:46 PM
Attachments: [SD Rosemont Groundwater Mitigation -working doc.9April2014.docx](#)

All,

As follow-up to the meeting/conference call BLM hosted with Rosemont on March 14th, the enclosed represents the list of projects/parcels/concepts that we at BLM Arizona are interested in discussing with the company. You may recall that Rosemont opened the door for us to specifically provide a list of projects they could voluntarily consider as part of the ROD that we at BLM deemed important or beneficial to the NCA.

We have outlined a number of projects to discuss under the following headings:

Ground Water Monitoring
Mine Dewatering and Ground Water Modeling
Riparian and Watershed Restoration
Threatened and Endangered Species Education and Conservation
Land and Conservation Land Acquisitions.

This list of projects will be utilized for discussion purposes with the company and are not intended for any other purpose. We plan to meet with Rosemont early next week to discuss the enclosed.

Ray Suazo
State Director
BLM Arizona

Proposed Rosemont Copper Mine Mitigation Projects

Ground Water Monitoring – Rosemont will establish and fund a long term ground water monitoring program specifically for monitoring wells, seeps, springs and riparian areas identified by BLM of specific importance to the Las Cienegas National Conservation Area (LCNCA).

\$200,000	Provide funding to USGS to continue to operate and maintain a real time stream flow monitoring station on Cienega Creek on LCNCA.
\$250,000	Develop and support a ground water monitoring program that provides a baseline for water resource conditions and supports in stream flows on Cienega Creek and Empire Gulch.
\$ 60,000	Analyze existing water source data, provide new monitoring to fill in any data gaps, and conduct modeling to determine aquifer recharge and flow paths. Includes inventory of springs and seeps on the LCNCA and isotope analysis for source and age of surface waters.
\$120,000	Use airborne LiDAR (Light Detection and Ranging) to inventory LCNCA for vegetation and stream channel morphology, providing a baseline for vegetation in the NCA and an assessment of past restoration efforts. LiDAR is a remote sensing technique using laser light to map topography at extremely high horizontal resolution and vertical accuracy. LiDAR is capable of mapping ground surface through vegetative cover. By re-mapping an area over time, LiDAR offers the ability to identify changes in erosional features such as headcuts as well as changes in stream morphology. Multi-frequency LiDAR is capable of estimating vegetative volume of riparian canopies by mapping the top of canopy elevation and subtracting ground elevation.
\$100,000	Provide support to BLM to continue landscape-level scenario planning work with partners to identify and pursue adaptation strategies for alternative future conditions that may result from combinations of climate change impacts, Rosemont mine impacts and other regional changes/impacts. Adaptation strategies may include watershed restoration, stream/spring restoration, changes in land management and other strategies to increase resiliency in systems. Includes climate monitoring.

\$730,000

Mine Dewatering and Ground Water Modeling - Rosemont agrees to both re-evaluate the existing EIS groundwater models and evaluate additional mining techniques to reduce or eliminate ground water inflow into the pit lake. The pit lake serves as an evaporation source and thus is a continual groundwater draw, lowering ground water elevation contours to the detriment of springs, seeps and riparian areas identified by BLM of specific importance to the LCNCA.

Rosemont agrees to provide BLM the opportunity to review and comment on the revised model analysis results for identification and selection of additional mining techniques for

evaluation and incorporation into final mine dewatering and water control designs, which reduces or eliminates the pit lake as a source of perpetual evaporation and associated groundwater drawdown inclusive of but not limited to:

- Optimize traditional ground water control techniques and final designs accomplished by diversion and pumping. *See Attachment 1, Figure 1.*
- Optimize backfilling the pit to an appropriate elevation with geomembrane and/or zoned impervious or low permeability materials or municipal waste. *See Attachment 1, Example 1.*
- Optimize alternative ground water control techniques and final designs accomplished by Exclusion. *See Attachment 1, Example 2 & Figure 2.*

Riparian and Watershed Restoration - Rosemont will provide funding to assess riparian and watershed conditions, prioritize and restore function to compromised areas for the benefit of enhanced water recharge to mitigate impacts to the LCNCA.

\$1,200,000	Provide analysis, design, construction and on-going maintenance of stream restoration projects on Cienega Creek and its tributaries, Mattie and Wood Canyons within the LCNCA.
\$1,000,000	Provide funding for BLM to enhance resiliency of floodplain sacaton grasslands through restoration projects including erosion control in rills and gullies, replanting of bare areas with native grass plugs, removal of invasive shrubs and trees, and planning for potential application of prescribed fire. Supports development of adaptive management strategies for floodplains and continuation of monitoring effectiveness and ecological response.
\$ 385,000	Provide funding to conduct stream/arroyo restoration assessment on Cienega Creek tributaries and install erosion control structures or other stream restoration techniques as determined by the assessment.

\$2,585,000

Threatened and Endangered Species Education and Conservation - Rosemont will provide funding for public education and conservation projects identified by BLM for threatened and endangered jaguar, fish, frog and turtle populations with emphasis on establishment and maintenance of wildlife waters to maintain wildlife linkages of the LCNCA.

\$ 180,000	Implement conservation activities for the threatened Chiricahua leopard frog, endangered Gila topminnow and endangered Gila chub on Las Cienegas NCA by reducing the threat of bullfrogs in the watershed; continuing the head start facility at Empire Ranch for the species and continue establishing, maintaining and monitoring leopard frog and native fish refugia sites on the LCNCA.
\$ 19,000	Evaluate interactions of turtles, invertebrates, native fishes, and

	native ranid frogs using replicated outdoor mesocosm experiments to better understand ecology of aquatic species.
\$ 50,000	Provide funding for BLM to partner with AZ Game and Fish Department to re-establish beaver into the LCNCA as a management tool for improving riparian/wetland (cienega) habitat diversity.
\$ 80,000	Improve and repair existing, non-functional livestock windmills and wells on the LCNCA to provide water to enhance wildlife movement corridors, replace water sources lost by mine and provide refugia sites for aquatic species.
\$ 100,000	Genetic study of Chiricahua leopard frogs population at Empire Gulch spring (impacted or lost due to the mine) that seem to be resistant to the Chytridfungus. This would help determine if this is a unique population.
\$ 100,000	Analysis of skin flora on Chiricahua leopard frogs from different areas in watershed to assess if certain flora increases the frogs survival rate.

\$529,000

Land and Conservation Land Acquisition- Rosemont will provide funding to acquire parcels and/or conservation easements identified by BLM, preferably within or adjacent to the LCNCA acquisition planning boundary. Emphasis will be on inholdings with significant recharge or surface flow capacity that may be applied or retired for the benefit of the LCNCA. Three priority natural resource valuable properties have been identified as being available from willing sellers.

\$14,000,000	Conservation easement purchase on the Vera Earl Ranch. Located northwest of Sonoita near Gardner Canyon. Approximately 7,000 acres total.
\$4,800,000	Fee purchase of the Rose Tree Ranch acreage. Located east of Sonoita. Approximately 1,200 acres.
\$5,500,000	Fee purchase of acreage within the Sands Ranch near the northeast edge of the LCNCA. Approximately 1,920 acres may be available for purchase.

\$ 24.300.000

These three properties acquired will provide long term protection of watershed, grassland ecosystems, wildlife and plant habitat, scenic views, and open space values.

Attachment 1

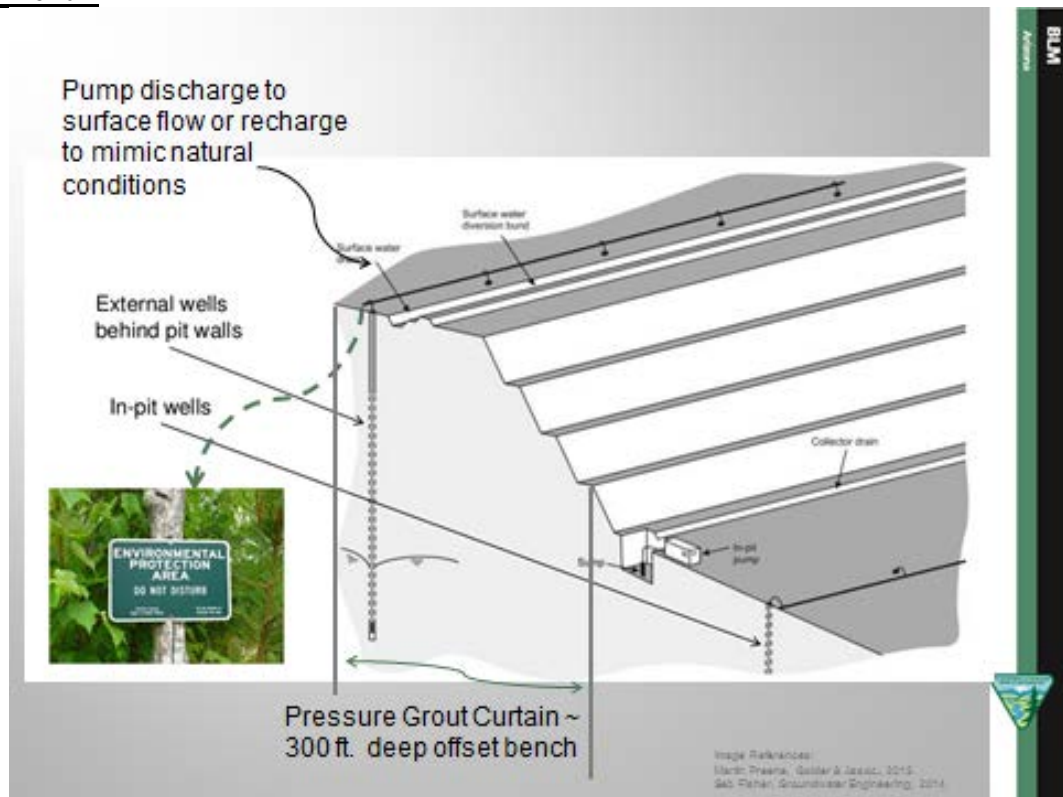


Figure 1



Example 1: The first geomembrane-lined mine pit backfilled with conventional tailings was the El Valle mine pit located in northern Spain. The gold mine pit was depleted of ore and in 2004, the bottom portion of the 500–1,700ft (152–518m) deep mine pit was backfilled to above the existing groundwater conditions with a low permeability clayey waste rock site grading fill in preparation for geomembrane liner placement. The clayey mine waste materials were taken from local mine stripping operations to expose the deeper ore materials.



Example 2: Diavik Diamond Mine Quantities: 32,000 m² Cut-Off Wall (COW), 80 cm width, Plastic concrete. 12,000 m² jet grout cut-off into the weathered rock with grout curtain

Groundwater Control by Exclusion

- ▣ **Displacement Barriers**
 - Good for soft shallow conditions
 - Inexpensive but not applicable
 - Sheet pile
 - Shotcrete
- ▣ **Injected Barriers**
 - Significant lateral extent and depth (400 ft)
 - Pressure Grouting
 - Rock Grouting
 - Jet Grouting
 - Insitu Mixing
- ▣ **Excavated Barriers**
 - Significant lateral extent & moderate depth (25-200 ft)
 - Concrete Diaphragm walls
 - Bored Pile Walls
 - Slurry Walls and Trenches
- ▣ **Artificial Control**
 - Ground freezing

Physical cut-off walls are installed around a site to exclude groundwater from shallow alluvial or drift deposits, or to seal off preferential flow along permeable strata

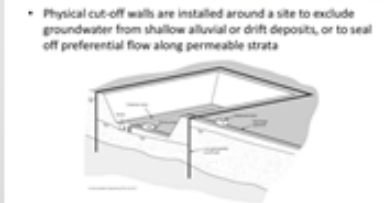
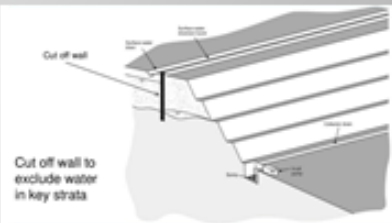



Image References:
 Martin Preana, Golder & Assoc., 2013
 Seb Fisher, Groundwater Engineering, 2014



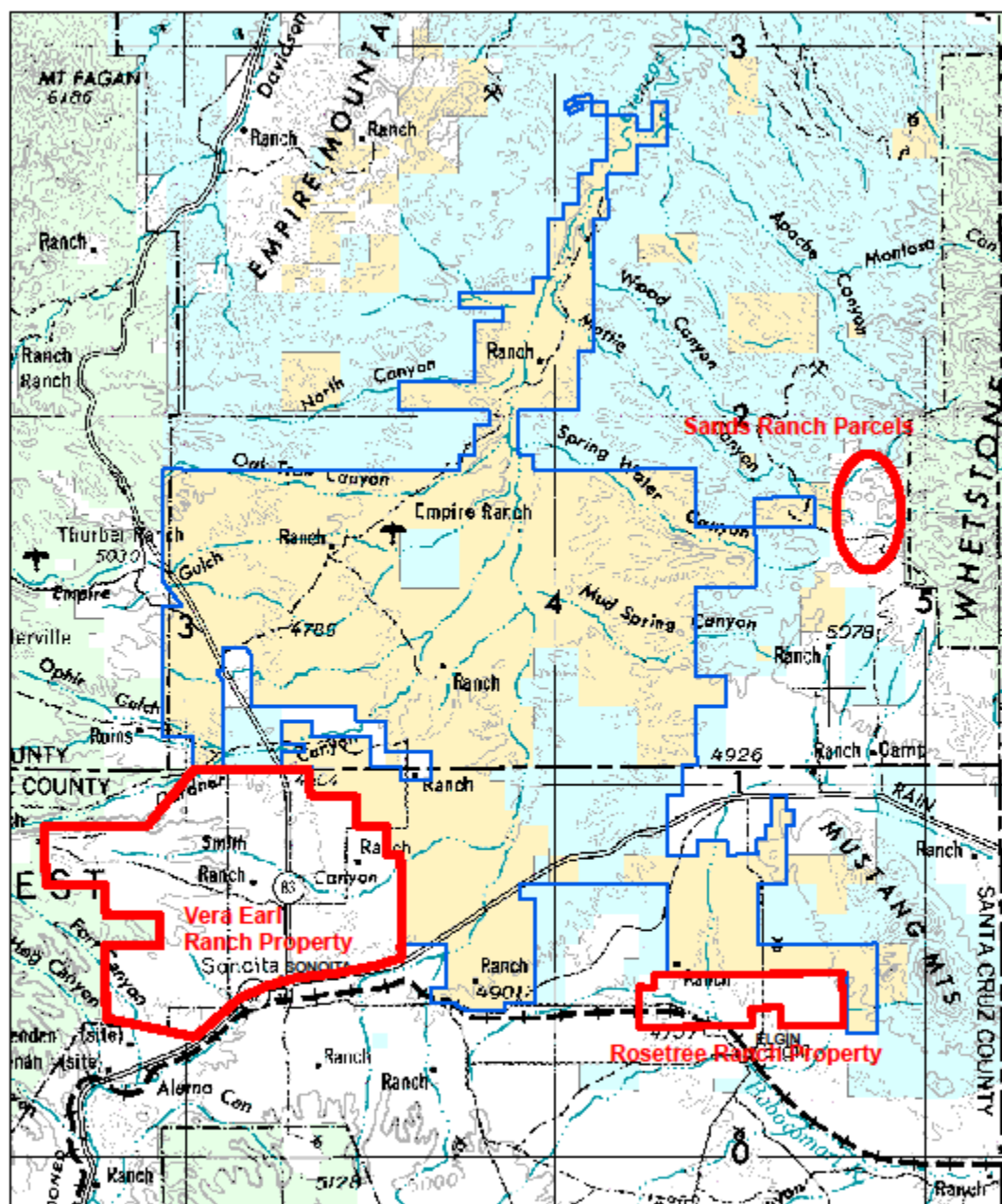



Figure 2

Text



United States Department of the Interior
Bureau of Land Management
Arizona State Office
Land Status updated as of February 2014
Map Prepared: 4/7/2014

Document Path: T:\AZ\State_Officials_user\mwwm\Rosemont Project.mxd

